The Cloud Chamber

In this activity[1] you will use a device called a cloud chamber to observe the footprints of radiation in a dense gas.

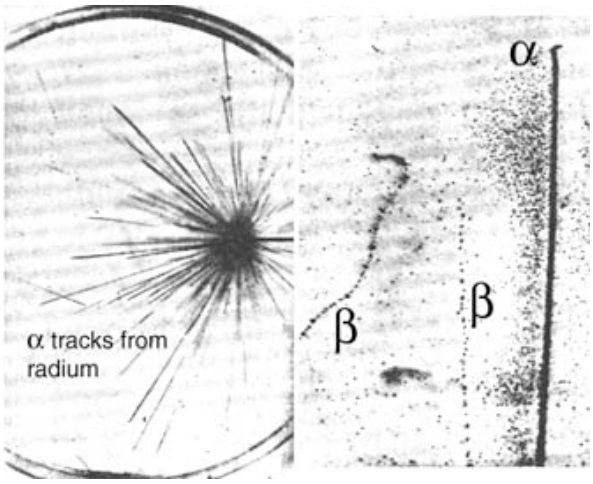
Objectives:

- Define and identify common examples of radiation.
- Distinguish between non-ionizing and ionizing radiation.
- Describe the differences between alpha (α), beta (β), and gamma (γ) particles.
- Determine what methods of protection are necessary for each type of radiation.

Research Question:
It is January 16, 2023; your team continues to develop recommendations for materials to be used for spacesuits and habitation units on the Moon. How much protection do we need from alpha, beta and gamma radiation on Earth? On the Moon? In space?

Discussion Questions:

- Do you see radiation in the cloud chamber? Why or why not?
- What is happening to the radioactive source?
- How do things become less radioactive as time passes?



An alpha particle left a broad, straight path of definite length while an electron produced a light path with bends due to collisions. Gamma rays did not produce a visible track since they produce very few ions in air.

[1] http://www.nrc.gov/reading-rm/basic-ref/teachers/unit1.html#activity_1

Materials:

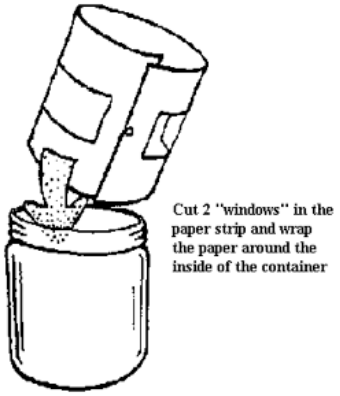
- small transparent container with transparent lid
- flat black spray paint
- blotter paper
- pure ethyl alcohol
- radioactive source
- masking tape
- dry ice and gloves or tongs for handling
- Styrofoam square
- flashlight

Directions:

1. Paint the bottom of the container with black paint and let it dry. Cut the blotter paper into a strip about as wide as the height of the container. Cut two windows in the strip, as shown, and place it against the inside of the container.

2. Pour enough ethyl alcohol into the cloud chamber to cover the bottom of the container. The blotter paper will absorb most of it.

3. Place the radioactive source in the cloud chamber and seal the lid with tape.



Caution: Dry ice should be handled very carefully! It can burn unprotected skin.

4. Place the cloud chamber on the dry ice to super-chill it. Wait about five minutes. Darken the room. Shine the flashlight through the windows of the chamber while looking through the lid. You should see "puffs" and "trails" coming from the source. These are the "footprints" of radiation as it travels through the alcohol vapor. The vapor condenses as the radiation passes through. This is much like the vapor trail left by high-flying jets.

Each kind of particle will have a unique footprint:

- Alpha: sharp tracks about 1 cm long
- Beta: thin tracks 3 cm to 10 cm long
- Gamma: faint, twisting and spiraling tracks

(**Note:** Equipment and materials for this activity are commercially available from various educational resources.)

References:

http://www.nrc.gov/reading-rm/basic-ref/teachers/unit1.html#activity_1